2005 Roundup of Auto Electronics Suppliers, N.A. and Europe

A utoliv Inc.
2005 C onsolidated Sales: $6,204.9 million
C hange from 2004: up 1.0%
2005 N et Profit: $292.6 million, or 4.7% of sales, compared with 5.3% net margin in 2004
2006 Estimated Sales: Organic sales are expected to be flat.

A irbag products including electronics and steering wheels accounted for 66% of Autoliv sales; seat belt products accounted for 34%. Sales increased in North America by nearly 4% due to strong demand for curtain and side airbags. Unit production of side chest airbags increased 10%, and side head airbag production increased 20% compared with the prior year. Sales in Western Europe were down 4% as a result of a 3% drop in light vehicle production. In Japan, sales grew 6%, driven by strong airbag sales. Organic sales in the rest of the world increased 9% due in part to demand for seat belts in the growing light vehicle industry in Asia.

A utoliv serves all the world’s carmakers, but its largest customers are Ford, which accounted for 21% of sales, and GM, which accounted for 13% of sales.

T RW A utomotive
2005 C onsolidated Sales: $12,643 million
C hange from 2004: up 5.3%
2005 N et Profit: $204 million, or 1.6% of sales, compared with $29 million in 2004
2006 Estimated Sales: $12,800 million to $13,200 million

TRW grew sales through higher product volumes, despite decreased vehicle production at some of its major OEM customers. Turn to Roundup, page 3

G M Is Serious About Diagnostics

In September 2005, General Motors introduced its OnStar Vehicle Diagnostics service, which sends subscribers monthly emails about the health of their vehicles. Already 700,000 OnStar subscribers have signed up for the free service.

Once the system is activated, the OnStar module will poll other electronic control units connected to the bus for diagnostics data, which it transmits back to the OnStar call center. Those data, including any trouble codes, are translated into a simple-to-read email message that is sent to the subscriber. Color-coded icons indicate at a glance that all systems are okay or that some action is required. For example, if immediate action is necessary, a red icon appears. Monitored systems include the powertrain, airbags, antilock braking and OnStar. (See the complete list of monitored functions below.) The OnStar Vehicle Diagnostics report includes an estimate of the remaining oil life and reminders about when the vehicle is due for scheduled maintenance. Subscribers can request extra diagnostics checks by pressing the blue OnStar button.

According to OnStar, what customers especially like about the service is convenience and peace of mind. “We listened to our customers,” noted OnStar spokesman, Keith Yaden. “They didn’t want us trying to sell them anything in the emails—no spam. They told us to make it simple. It helps them maintain their cars and maintain peace of mind that their cars are running well.”

While the OnStar system is truly remarkable, it’s only the beginning of what state-of-the-art diagnostics could bring to GM’s future customers. “The primary goal is to guarantee total customer satisfaction,” declared Patrick Popp, director of Electronics Controls and Software Labs at General Motors. “That means you’ve got no surprises, perfect quality, we reduce the cost of ownership, no hassles because you have to spend time at the garage. Diagnostics and prognostics are extremely important and a major enabler for new services, new features and access to additional revenue sources.”

Mr. Popp expects that in 10 to 15 years diagnostics systems will be so good at pinpointing a problem that repair shops will spend almost no time troubleshooting. “The vision is that if you ever go into a repair station it will only be to exchange a part.” And that’s only if the problem is with hardware. If it’s a controls or software-related problem, you won’t need to go to the repair shop at all. “Either we can flash our controllers remotely or we can apply self-healing techniques,” he said.

According to Mr. Popp, the emphasis on diagnostics will lead to major changes in automotive electronics systems. Turn to Diagnostics, page 8
Frischkorn Leaves BMW for GM

Having completed his work developing and implementing BMW’s system architecture strategy, Hans-Georg Frischkorn will take on a new and much more challenging job at General Motors, where he will have global responsibility for electrical systems, controls and software, starting April 1. He will report to Jim Queen, GM vice president, global engineering.

Known as a brilliant innovator with a clear vision of where automotive electronics is headed, Mr. Frischkorn has been a strong advocate of top-down systems integration, open system architectures, of modularization and the reuse of tested components and software. While at BMW he helped pioneer the Autosar open system architecture standard and the FlexRay time-triggered, deterministic network standard.

Mr. Frischkorn had been with BMW since 1997, most recently as senior vice president for system architecture and integration. Before that he was project leader responsible for the Z4 vehicle program and senior vice president responsible for electrical and electronics development. Prior to joining BMW, Mr. Frischkorn was a consultant at McKinsey & Company and had worked in product development at IBM. Mr. Frischkorn studied computer science at the University of Stuttgart, where he received a diploma in information technologies. His focus topics included software development methodologies and systems engineering.

Each of the directors of the GM regional electrical centers will have matrix reporting relationships to Mr. Frischkorn: MaryAnn Combs for North America, Gary Bandurski from Europe and Plinio Cabral Jr. for Brazil.


Market researchers at IC Insights, Scottsdale, Arizona, released a report in December 2005, which forecasts the market for automotive ICs will increase by 7% in 2006 to nearly $14 billion.

The report, which covers all major end-use applications, is available in print or on CD. For more information, contact Brian Matas at 480-348-1133 or visit www.icinsights.com.
Roundup...

Continued from page 1

tomers. Increased penetration of key TRW products such as electronic stability control, tire pressure monitoring and side airbags helped offset higher raw material costs and increased price pressures. Still, TRW expects that Ford’s and GM’s plans to reduce production will hurt TRW sales in 2006. Ford is TRW’s largest customer, contributing 16% of sales in 2005, followed by DaimlerChrysler and Volkswagen at 14% and GM at 11% of sales.

The company hopes its new line of advanced safety products launched at the IAA in Frankfurt in September, will buoy future sales. Among the new products shown in Frankfurt were pre-crash sensing, adaptive restraints linked to the radar cruise control, lane departure warning and brake assist.

The Chassis Systems operating segment accounted for 57% of TRW Automotive sales in 2005; Occupant Safety Systems accounted for 29.7%; and Automotive Components, including engine valves and body controls, accounted for 13.3% of total sales.

TRW announced in 2005 that it would close ten plants as part of its long-term plan to move operations out of high labor cost countries.

The company acquired Daphmetal, a Spanish manufacturer of steering wheels and airbags, in October 2005. That acquisition increased TRW’s net debt by €244 million, bringing total net debt to €2.6 billion, compared with €2.4 billion at the end of 2004.

Europe

As of 2005, publicly listed companies in Europe are required to report their financial results under IFRS (International Financial Reporting Standards) so some comparisons reflect restated 2004 figures.

Bosch Group Automotive Technology Sector

2005 Sales: €26 billion
Change from 2004: up about 4%

The Automotive Technology sector, with 158,000 employees, contributed 63% of total Bosch sales in 2005. Bosch cited diesel systems as an area of strong growth in 2005. The company expects that growth to continue in Europe, where already nearly 50% of new cars sold are diesel powered, and in China, where diesel penetration could reach 15% in the next ten years.

Bosch is predicting double-digit growth through 2015 in driver assistance systems such as night vision, adaptive cruise control and brake assist. Strong demand for electronic stability control continues in Europe, where nearly 40% of new cars are equipped with the feature. According to Bosch, 70% of all new cars registered in Germany in 2005 were equipped with an electronic stability control system. The European Commission recommended that stability control be made standard equipment.

Brose

2005 Sales: €2,200 million
Change from 2004: up 10.3%

2006 Estimated Sales: €2,220 million, up 0.9%

Most of Brose’s growth came from increased sales of door systems and seat adjusters. Sales in Germany declined 3%, to 46% of sales, while sales generated outside Germany grew by 24% to reach €1.2 billion. The privately-held company intends to grow sales to €3 billion by 2010.

Continental Automotive Systems

Preliminary results

2005 Sales: €5,230.6 million
Change from 2004: up 4.5%

2005 EBIT: 10.9% of sales

In 2005 Automotive Systems spent €385 million, or 7.4% of sales, on R&D. Development efforts in low cost countries such as Romania continue, and the company announced plans to build a development center in Yokohama, Japan, housing 250 engineers to support expanding business in Asia. Continental opened its Asian headquarters in Shanghai, China, in November 2005 and intends to double its sales in five years, from €500 million in 2005 to a billion euros in 2010. Through a joint venture and a wholly-owned subsidiary, the company produces electronic brake systems in China. Electronic components for brake systems and body electronics are manufactured in the Philippines.

Promising product lines include power electronics for hybrids, a new electronic brake regulator system, and integrated active and passive safety systems enhanced with image processing. Unit sales of electronic stability control increased 42%, while ABS and traction control systems were down 9%.

Magneti Marelli

2005 Net Sales: €4,033 million
Change from 2004: up 6.3%

2005 Trading Profit: €162 million

2005 Electronics Systems Division

Sales: €513 million, up 10.3% from 2004

Magneti Marelli, a Fiat subsidiary, is the hardware provider for Fiat’s new telematics platform developed with Microsoft. In September 2005 the company signed an agreement with Autoliv to jointly develop a platform for emergency services. A proposal is under consideration in Europe to make E-call functions mandatory beginning in 2009. The platform could be expanded to include other functions such as stolen vehicle tracking and remote diagnostics.

Magneti Marelli has 31 R&D centers, according to the company website, and invested 5.7% of sales in R&D in 2005. R&D spending for the Electronics Systems business in 2005 amounted to 8.5% of sales.

Siemens VDO Automotive

Fiscal year ending September 30, 2005

FY 2005 Sales: €9,610 million
Change from FY 2004: up 7%

FY 2005 Profit: €630 million, or 6.6% of sales, compared with 6.2% in FY 2004

Siemens VDO’s growth was primarily due to the full-year consolidation of the former Huntville Electronics business, which it acquired in 2004. Orders increased 8%. A automotive electronics generates 50% of Siemens VDO’s sales.

At the 2005 Frankfurt Auto Show (IAA) Siemens VDO announced it was developing brake-by-wire systems for 12-volt vehicles, which it will market within this decade. Siemens VDO is also developing advanced driver assistance systems, a market it sees growing at 20% per year.

Other growth segments the company is targeting include piezo fuel injection, hybrid drives and infotainment systems.

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TomTom N.V.

Distinctions Claimed by TomTom

◆ With more than 50% of the market, TomTom is Europe's number-one supplier of personal navigation devices.
◆ In December of 2005, TomTom sold more personal navigation devices in the U.S. than any other supplier except for one, Garmin.
◆ TomTom was the world's first company to develop navigation software for PDAs.

Taipei, Taiwan. Inventec Appliances Corporation has had all of TomTom's business until the first quarter of 2006, when Quanta Computer, which also makes a third of the laptops produced worldwide, began producing GPS systems for TomTom. By leaving manufacturing to its contractors, TomTom managers have more time and resources to focus on product design and marketing. The company also outsources supply chain services including packaging, testing, warehousing and shipping. TomTom owns no patents for the technology applied to its products, though it has filed a number of applications.

Publicly traded and listed on Eurolist by Euronext Amsterdam under the symbol Tom2, TomTom successfully completed its initial public offering in June 2005, raising a total of about €467 million. Opening at €17.50 per share on May 27, 2005, the stock price had risen to €27.05 per share by February 16, 2006. TomTom does not intend to pay dividends to stockholders.

The majority of TomTom products are purchased at retail stores. Most products are sold through retail distributors; the two largest are Ingram Micro (Santa Ana, California) and Mobile Communications Company BV (Naarden, The Netherlands). A typical TomTom customer is keen on consumer electronics, is 35 to 45 years of age, college educated and male, with a household income of around $75,000. Many TomTom customers spend a lot of time in their vehicles.

Background

Very profitable with skyrocketing sales, TomTom is not at all your typical automotive electronics supplier. While dozens of suppliers are beating each other up on price for the opportunity to have their navigation equipment factory installed by carmakers, TomTom has taken its case directly to consumers, who are buying what they sell in record numbers. TomTom's portable navigation devices work right out of the box; no professional installation is necessary.

TomTom's lineage goes back to a small software company called Palmtop, which was formed in 1991 to develop applications for handheld computers. The company grew along with the market for those devices, producing applications such as dictionaries, personal finance organizers, games and route planners. In 2001, under the leadership of Harold Goddijn, former CEO of the U.K.-based company Psion, the company narrowed its focus on the personal satellite navigation device market and renamed itself TomTom.

TomTom outsources manufacturing of its portable navigation devices (PNDs) to two contract manufacturers located in

Corporate Head Office: Rembrandtplein 35, 1017 CT Amsterdam, The Netherlands
Products: Personal navigation products
Key Markets: Europe first, followed by North America
2005 Sales: €720 million
R&D: 1.2% of sales
Marketing Expenses: 8.8%
Operating Margin: 27%
Net Margin: 20%
Current Ratio*: 3.3 as of December 31, 2005
Cash Generated from Operations: €103.5 million
Shareholders' Equity: €306 million as of February 16, 2006
Market Capitalization: €2.90 billion as of December 31, 2005
Employees: 450 as of February 2006
Sales per Employee: €.65 million
* A measure of liquidity: current assets divided by current liabilities
Germany and France are also important markets. According to TomTom, the European market for portable navigation devices will grow from 3.8 million units in 2005 to 7 million units in 2006.

TomTom began doing business in the United States in December 2003, when it opened its office in Concord, Massachusetts, near Boston. By December 2005, TomTom rose to the number-two position in the fast-growing U.S. market with a 25% share of the portable navigation devices sold in that month. Between 700,000 and one million PND units were sold in the U.S. throughout 2005, according to TomTom.

**Portable Navigation Devices Edging Out the Alternatives**

TomTom’s success is putting a crimp in the market for embedded navigation devices. In 2005, TomTom sold 1.7 million portable navigation devices and expects to sell as many as 3.3 million of them in 2006. Portable navigation devices cost one-third to one-half the price of factory-installed embedded navigation, and they can be moved from one car to another. “Transportability is a key factor we have always believed in,” explained Mark Gretton, development director, in charge of hardware engineering. “You can sell your car, you can borrow your wife’s car, you can take a trip and put the device in a rental car. That is very important.” Before joining TomTom, M r. G retton worked with TomTom CEO and cofounder, Harold Goddijn, at Psion. M r. G retton, who manages product development from an office in London, is credited with the development of the TomTom GO all-in-one navigation solution.

Jocelyn Vigreux, president of TomTom USA, sees an analogy between embedded navigation devices and embedded mobile phones. “Navigation will follow the same paradigm as car phones. You will see some traction on built-in devices the same way we saw phones being built into cars in the 80s and 90s. Ultimately, as has happened with portable phones, the function will follow the user.”

According to a survey by the market research firm G f K Group (Nuremberg, Germany), a strong majority of car owners in Western Europe who own navigation systems use portable navigation devices like those made by TomTom: 59% in Germany and 70% in the United Kingdom. Most of the rest have navigation devices that are factory-installed: 28% in France, 22% in Germany and 16% in the United Kingdom. Nearly all the remaining car navigation owners had their equipment fitted by dealers, garages or installers: 7% in France, 14% in Germany and 10% in the U.K.

The PDA market is not growing as fast as the personal navigation device market. Compared with a PDA, a PND is uncomplicated. Mark G retton: “Not getting lost in a car is a very identifiable, straightforward problem that you can solve with a straightforward, identifiable box that does that job. The PND is accessible to every single car driver; that’s a very big market.”

TomTom also makes navigation software for smartphones, but that application too is eclipsed by the success of PNDs. According to M r. G retton, “Most people don’t have smartphones, they have low-end or medium phones with no color screens, no memory card slots. Those phones don’t have the processing power, the screen isn’t big enough to see and the audio isn’t loud enough to hear when you are driving along. You can do navigation on a smart phone, but you compromise the experience to such a degree that the product is not attractive to most people.”

**Products**

First introduced in March 2004, integrated devices already account for 86% of the company’s sales for 2005, compared with 40% in 2004. All TomTom’s integrated devices provide door-to-door navigation via voice instructions (in more than 30 languages and 50 voices) complemented by 3D graphics. Included is a 3.5-inch, full-color, touch-screen TFT LCD, an internal rechargeable Li-Ion battery, a cigarette lighter cable, built-in GPS antenna, built-in Bluetooth transceiver and a USB connection to download maps from a PC. All GO units can easily be moved from one car to another.
TomTom GO

Priced at €429 in The Netherlands, the TomTom GO 300 comes with a map of a single region or country provided on a removable SD Flash memory card.

At €529 the TomTom GO 500 provides all that the 300 provides but expands door-to-door navigation to any town within Europe via SD cards. It also features hands-free calling via Bluetooth using your own Bluetooth enabled mobile phone.

Priced at €629, the TomTom GO 700 comes with a 2.5 GB hard drive that contains a single map sufficient to navigate door-to-door throughout Europe. It also comes with a remote control device.

In the United States the TomTom GO 300, with an SD map of the U.S. and CD of Canada for PC download, retails for $599.95; the TomTom GO 700 with a hard-drive mounted map of the U.S. and Canada retails for $799.95. TomTom GO 500 is not available in the United States.

TomTom ONE

In November 2005 TomTom introduced TomTom ONE, its newest, smallest, most affordable and most portable integrated navigation device. A bout the size of a wallet, TomTom ONE sells for just €399 in The Netherlands.

TomTom RIDER

A weatherized version of TomTom GO designed for motorcycles, TomTom RIDER includes a sun visor and user interface that works while wearing gloves. Voice instructions can be heard through an included Bluetooth headset worn inside a helmet. The price in The Netherlands is €599. The first RIDER shipments began in December 2005.

TomTom NAVigatOr

The company first started packaging navigation software for PDAs in 1996. Navigator 5 is the latest version. Priced at $299.95, Navigator 5 turns a PDA into a wireless portable navigation system. The navigation software and map come on an SD card along with a GPS receiver that connects to the PDA via Bluetooth wireless link. Navigator 5 is compatible with scores of PDA’s from PalmOne, Sony, Hewlett-Packard and several other makers. The functionality and user interface of TomTom Navigator is similar to TomTom GO.

TomTom MOBILE

Retailing for €299, TomTom MOBILE 5 brings door-to-door navigation to a variety of smartphones. The navigation software and map data comes packaged on a memory card, either RS-MMC, mini SD or Memory Stick Pro Duo. Also included is a GPS receiver that connects to the smartphone via Bluetooth. TomTom MOBILE is not available in the U.S.

TomTom PLUS (services)

The company began offering location-based content and services in April 2005 on a subscription basis. Products include real-time traffic data, map downloads, software updates, weather information and points of interest databases. A one-year traffic subscription for all of Europe costs €79.95. For €39.95 TomTom users can download the location of all the safety cameras located in France and the U.K. Safety cameras are used by public safety authorities to catch speeders. Subscribers can access the TomTom PLUS online portal from the company’s website and download additional content to use on their TomTom navigation devices.

New Products

In March 2006, TomTom announced three new products: GO 510 will replace the GO 300 and GO 910 will replace GO 700. Both products will feature more capability, including connectivity via Bluetooth to MP3 players that could play on the TomTom speaker or the vehicle’s audio system, and a wider LCD screen. A new feature is Buddy Finder which works in a manner similar to an instant messenger program except users will also be able to view their buddies’ positions on their navigation screen. Users must connect to a compatible Bluetooth enabled phone with a GPRS (General Packet Radio Service) data plan.

TomTom GO 510 with SD card will retail for $699; GO 910 with 20 GB hard disk drive will sell for $899. Both will be available on April 15, 2006.

The third new product, TomTom WORK, is aimed at fleet owners and operators. A key element of WORK is Webfleet, which takes advantage of the Internet to help fleet managers keep track of the status and location of their vehicles. GO 710 and 910 can be used along with Webfleet as the navigation and communications element of the system.

TomTom acquired the Webfleet technology when it purchased Datafactory, a Leipzig, Germany-based, fleet location and tracking company, in September 2005. Datafactory employs about 30 people and realized annual sales of about €5 million in 2004 and 2005.

Technology

All TomTom navigation products, both the integrated and non-integrated, are based on a single software platform the company refers to as the NavCore platform. As a result, all TomTom products have a similar identity. And further, since the NavCore platform is flexible, TomTom engineers can quickly change the product without a lot of re-engineering. NavCore can run on any mobile device with sufficient memory, processing power and an operating system. Compatible operating systems include Linux, Windows, Windows CE, Pocket PC, Microsoft Smartphone, Palm/OS and all Symbian/OS variants including Nokia and Sony Ericsson.

When applied to TomTom’s line of integrated products, the NavCore platform...
that runs on top of Linux. That is not
sure of proprietary intellectual property.
governing its operating system because of fears that the gen-
avoided using the Linux open source operating system
... We just add a bit of software to that user interface, Bluetooth and Internet
ready been developed: communications, power to offer all sorts of advanced fea-
to offer the TomTom GO as an accessory on both the Toyota Yaris and Toyota Corolla.
Opel/Vauxhall (UK): A special edition Corsa equipped with a TomTom GO 300 was advertised and available throughout ten European countries. In the U.K., Vauxhall has extended its offer of the TomTom GO on the Corsa to include all commercial vehicles.
Peugeot: In the U.K., Peugeot provides the TomTom GO 300 as an approved satellite navigation option.
Hyundai: In the U.K., Hyundai offered the TomTom GO range through its dealer network.
DaimlerChrysler: TomTom will continue its sales and marketing activity with DaimlerChrysler, specifically throughout the Smart dealerships. Chrysler in Germany is currently offering the TomTom GO 500.
Lancia: In Italy, Lancia promoted the TomTom GO 700 on its Ypsilon model, supported with a strong advertising campaign.
Chevrolet: In Spain, the TomTom GO 300 was offered throughout the Chevrolet range, promoted with a heavyweight advertising campaign.
SEAT: TomTom recently announced a cooperative agreement with SEAT to provide the new TomTom ONE on the SEAT Altea and SEAT Toledo.
Citroën: In Belgium and Holland, TomTom navigation devices are offered as an approved accessory.
Fiat: Beginning March 1, 2006, Fiat France will offer the TomTom ONE as a navigation option.
Renault: TomTom continues to be the number-one selling portable navigation system with Renault.
BMW: In Germany, BMW is offering TomTom as a navigation accessory option throughout its range.

is run on the open source operating system Linux. "That gives us tremendous power to offer all sorts of advanced features that keep up with the consumer electronics industry," suggested M r. Gretton. "Linux is robust and mature, which automotive people like. A vast amount of code based on Linux has already been developed: communications, user interface, Bluetooth and Internet connectivity, all of the multimedia stuff. ... We just add a bit of software to that and thereby upgrade our system."

Some infotainment developers have avoided using the Linux open source operating system because of fears that the general public license governing its royalty-free use might necessitate disclosure of proprietary intellectual property. But M r. Gretton doesn’t see the problem. "Our navigation software is an application that runs on top of Linux. That is not published. If you understand it and handle it properly, the GPL is perfectly workable."

Roughly half of all of the integrated portable navigation devices TomTom sells come with Flash card slots and SD cards; the other half are equipped with hard disk drives. But, as semiconductor prices decrease, Flash memory usage will increase.
At TomTom, that transition to Flash is aided by the company’s map tool chain, which tightly compresses the map data from suppliers Tele Atlas and NAVTEQ to a compact form. Indeed, TomTom can now fit an entire U.S. map on a one-gigabyte SD card. Most of TomTom’s map databases are supplied by Tele Atlas.

A applied Generics is developing technology that collects real-time traffic information by anonymously monitoring mobile phone networks.
Mr. Gretton explained what TomTom sees in A applied Generics. “Right now we can promise to get our customers from A to B without the stress of ever getting lost. The next thing we want to do, which is much harder, is get them from A to B by the quickest route, at any given time of day.”

A applied Generics is only one or two years away from being able to offer its network analysis software to network operators, who would run the software on their equipment. “The technology itself is working beautifully; it is astonishingly accurate. A bigger challenge is for us to get the right business and commercial agreements in place with the right type of cell operators,” said Mr. G retton.

While the Aplied Generics technology promises to make traffic collection much less expensive, it doesn’t work in dense urban areas. “It's not the entire solution,” noted Mr. G retton. Aplied Generics employs 18 people and realized sales of approximately €1 million in 2005 and a small net loss.

OEM Market
While TomTom is focused almost entirely on the retail market for portable navigation devices, it has made some important incursions into the OEM market. Most notable is its deal with Toyota, which since May 2005 includes a TomTom GO 500 portable navigation device with each Toyota Aygo sold in Europe. “It's a semi-fixed installation,” said Mr. G retton. “We engineered a docking shoe, a small round disk, that's line-fitted to the dashboard of the car, and wired inside. When the GO unit is inserted into the shoe, it uses the vehicle's audio system just like an integrated navigation system, but you get the benefit of being able to take it with you and use it in your wife's car or a hire car if you need to.”

That deal may lead to other OEM business with Toyota. For example, Toyota has seen in “fairly high-level discussions” with TomTom to integrate TomTom’s navigation system with Toyota. For example, Toyota has been in “fairly high-level discussions” with TomTom to integrate TomTom’s navigation system with Toyota.
navigation hardware and software into the Scion, Toyota's affordable, compact car line aimed at trendy buyers. A nomadically, that would probably involve a fully embedded installation, where the GO unit will be permanently affixed to the vehicle.

Given its dramatic success bringing affordable navigation equipment to the mass market, TomTom feels it has much to offer Carmakers. "Navigation shouldn't only be an option on the high-end cars," said Mark Gretton. The core of TomTom's portable navigation device (operating system, user interface, navigation software, Bluetooth connectivity, microcontroller, memory and display) is equally applicable to the dashboard.

TomTom says it can help Carmakers bring navigation to market at half the price of today's embedded systems, in a matter of months as opposed to years. "We are going to the OEs and rather than saying, 'We are just another contract manufacturer willing to make something to your spec,' we suggest 'How about you take this module, which we know works ergonomically and delivers class-leading performance, and we will help you build it in,'" explained Mr. Gretton. TomTom has made expanding its automotive OEM business one of the company goals for 2006.

### Roundup...

**Valeo**

2005 Net Sales: €10,033 million
Change from 2004: up 8.0%

2005 Net Profit: €141 million, or 1.4% of sales, compared with €241 million, or 2.6% of sales in 2004

Valeo's acquisition last year of Johnson Controls Engine Electronics (formerly a Sagem business) and the remaining stake in two climate-control joint ventures it owned with Bosch contributed €633 million in sales in 2005.

The company is expanding its manufacturing operations in Asia as part of its strategy to earn 25% of total revenue from Asia by 2010. Valeo formed another joint venture in China—its twelfth—to manufacture ultrasonic park assist systems.

In 2005, 10% of sales were in Asia; 69% of sales were from Western Europe. Valeo saw a 5% increase in sales to its largest customer, Renault-Nissan. Sales to General Motors fell 10%.

**ZF Friedrichshafen**

2005 Sales: €10.7 billion
Change from 2004: up 7%

Sales in the Car Driveline Technology division were up 9%; the Car Chassis Technology division's sales grew 14%. ZF Linkssysteme, a joint venture with Bosch for steering systems, increased sales 8% in 2005.

ZF and Continental Automotive Systems agreed to jointly develop and market hybrid systems and components. Their first major customer is Volkswagen, which placed an order for hybrid drive modules, consisting of an electric drive and power electronics, for a development project that will go into series production.

ZF Engineering is a new division that was created to work with customers on functional integration and networking of vehicles' chassis and transmission systems. At the Frankfurt Auto Show, ZF showed the potential of actively networking transmissions, axle drives, steering systems, suspension systems and other chassis components. The networked system can quickly compensate for load changes, yaw moments and vibrations, and it can optimize steering angle, stability and brake torque.

### Diagnostics...

- Today, diagnostics is focused mostly on components. In the future, diagnostics will focus more on features, which are often distributed among several different electronic control units.
- Designing the diagnostics algorithms will move from the end of the design process, where today it is often an afterthought, to the front of the process. Diagnostics code will be embedded into the controller at the same time as the control code.
- Future automotive electronics systems will have two gateways to the outside world: One will connect to a remote diagnostics server, which collects data from the vehicle fleet. The second gateway will connect to the repair shop.
- More sensors will be needed, but most will be virtual sensors based on plant models.
- Today all GM controllers have Flash memory, but more Flash will be needed for data and for programming. Today, as much as 50% of the code stored in a powertrain controller is devoted to diagnostics.
- Advanced diagnostics will require more processing power.
- Mathematical models of more subsystems will be needed.
- Suppliers will take a greater role in the development, verification and documentation of the onboard and off-board diagnostics of their subsystems.

Improved diagnostics systems will not only help solve problems encountered in the field, but they will help engineers design better systems from the start. That will translate into significant reductions in warranty costs. Today between 1% and 5% of customers have serious electrical and electronics problems with their new vehicles, depending on the carmaker.

Improved diagnostics could even bring in some service revenues. Mr. Popp: "I could sell a proactive maintenance service to people who spend a lot of time traveling and park their cars at the airport for weeks at a time, which compromises the battery. When the state of charge on the battery is low, the vehicle could be automatically turned on to recharge."